XXXIV.—*Strange Phenomena in a Microscopic Cell.*

By H. J. Carter, F.R.S. &c.

[Plate XVII. figs. 1–9.]

There is, or was, a slight depression in the rice-fields of the island of Bombay which are situated on the eastern side of the main road leading from Ghorpudevi to Chinch Poogly (now laid down as the "Frere Land Company"), close to a shed in which buffaloes were kept; and during the rainy monsoon (that is, in our summer) this depression was always filled with water, into which the buffalo-shed drained itself. By the end of June a pool was thus formed; and by the month of August it abounded with many species of Infusoria, together with some aquatic plants, among which were *Anacharis* and *Chara*. To this pool I was often wont to go for microscopic objects, bringing away some of its water with me, and finally depositing it in basins for more deliberate examination.

On the 9th of August, 1856, while looking at the sediment of a basin of this water, which with a hair-pencil had been swept off the side and placed under the microscope, I perceived a transparent, oblong, colourless cell containing protoplasm charged with starch-granules, which protoplasm was circulating round it precisely like that in a living cell of the Characeæ; and after watching it for some time, a nipple-like portion began to project from one end of the cell, which, gradually extending itself into a long tube, was also accompanied by a corresponding diverticulum of the stream or cell of rotating protoplasm and starch-granules to its extremity, so long as it continued to grow. This cell was tolerably abundant in the water; and having often seen it during the month of August of two successive years, I concluded that it usually made its appearance in this pool about the time mentioned; but I never found it in the water of any other pool or tank in the island of Bombay. (Plate XVII. figs. 1, 2.)

To meet with a colourless transparent cell not more than the 500th part of an inch long and much less in breadth, presenting an active, rotatory protoplasm densely charged with starch-granules of a peculiar shape, and putting forth a tubular prolongation, into which was extended the same circulation so long as the tube continued to grow, was at once so novel and so enigmatical, that I determined to record all that I could about it, although I might fail to find out its real parentage.

The detail of this record I will now give, beginning with a description of the cell, and then adding the phenomena which attended it, in order that others who have heretofore met, or may hereafter meet, with the same kind of organism, may also

find their observations thus corroborated, even if, like myself, they may not be able to decide on the class of beings to which this strange atom of vitality belongs.

Description of the Cell.—Cell-wall for the most part oblong, cylindrical, rather bent upon itself, sometimes elliptical and even globular; for the most part rigid, but sometimes flexible, and so plastic even as to exhibit a low degree of polymorphic, locomotive, and reptant power; transparent, colourless. Lined with a transparent film or inner cell, within which, again, is a layer of protoplasm, charged with starch-granules, sundry molecules, and a nucleus which revolves longitudinally (spirally?) around an axial (aqueous?) cavity. Mean size of cell 1-500th of an inch long by 1-1120th broad (Pl. XVII. figs. 1 & 5).

Hab. Freshwater pool in the rice-fields of the island of Bombay, which pool only contains water from about June to November inclusive. In company with a great number of species of Infusoria of all kinds, Algæ, and some aquatic plants, among which may be enumerated *Anacharis* and *Chara*.

Obs. The peculiarities of this cell were especially its reniform starch-granules, by which it might be recognized at any time (fig. 3, *f*), its rotating protoplasm, including the nucleus (fig. 1, *b*, *c*), and its sometimes plastic, reptant state, in which it was once observed to put forth one or two short processes (fig. 6, *a a*). Add to this its tendency to germinate (if we may apply the term to its tubular extension), which was so rapid that, under the microscope, it might be almost seen to grow (figs. 3, 4). That of fig. 3, *e e* (which, together with all the other figures of this cell, is drawn on a scale of 1-12th to 1-5400th of an inch) grew 1-70th of an inch in one hour, when the rotatory power of the protoplasm ceased (that is, became exhausted), the tubular extension stopped, and probably the whole perished. In no instance was this tubular prolongation, either taking place under the microscope or in specimens where it had already taken place in the water previously to examination, observed to go, or to have gone, beyond the tubular extension figured. Here the growth appeared to be always arrested. Whether or not it ever went further in the natural habitat of the organism I am unable to decide.

Another common occurrence in this cell was its proneness to become affected by endophytes, which (after causing in their usual manner the starch-granules to disappear, and to be followed by the presence of glairy oil-like albuminous (?) globules) developed the contents of their respective cysts, probably into monociliated monads, and, piercing the cell-wall of their host, thus discharged their progeny into the water (figs. 7, 8, 9).

The question now comes "What was this cell?" Had not the starch-granules invariably been reniform instead of circular, I should have inferred that the rotating protoplasm, including the nucleus, pointed out the *Chara* of the same pool as the only organism from which it could have originated; but the cocked-hat or kidney-like form of the starch-granule is so far opposed to this, that in no instance did I ever see the like in the Characeæ.

Again, the presence of the endophyte, which so commonly developes itself in the algal cell, and especially in that of the Characeæ, while it still further assimilates this remarkable cell to the latter, at once places it on the side of the algal and not on the side of the fungal cell. The presence of the starch-granules and their great number, together with the rotatory protoplasm, is also opposed to its being a fungal cell (whether Saprolegniean or Myxogastrean), of the flexible cellulose cell of Algæ &c. or of the rigid woody one of timber.

Of the absence of the green chlorophyll vesicles I take no account, because I have often seen the circulation of the protoplasm going on in the older internodes of *Nitella*, where the green layer has been absent; and, indeed, this is the normal state of the root-cell.

Montagne, in a back number of the Ann. des Sc. Nat. (Bot. 3^{e} sér. t. xviii. p. 65), states that he found little cells (*bulbels*) in the nodes of *Chara* (white, from being filled with starch-granules), which germinated; and the vitality of such little cells I know, from actual observation, to be so extremely durable that for 8–10 months I had a single living green one of microscopic minuteness, which, situated in the midst of an otherwise dead node of *Chara* (by whose means alone it could be kept under observation), presented at the end of this period a circulatory movement of the protoplasm equally quick with what it had been at the commencement. Then it should be remembered that this cell retained the green layer throughout, and was sufficiently large to be viewed with an inch, while those above-described could only be seen with a quarter-of-an-inch compound power. Montagne's "*bulbels*," too, which germinated, probably merited strictly the term applied to them, viz. "little" rather than "microscopic," the only term which correctly designates mine.

Here, then, I leave the record, whose publication I a long time postponed in the hope of obtaining more satisfactory information about this curious cell, merely adding to those who may consider this communication worth reading, "Beware how, without direct evidence, you set down this cell as belonging to the Characeæ, when I, who have given much study

to them elementarily, as may be seen in the pages of this periodical, hesitate to come to such a conclusion."

EXPLANATION OF PLATE XVII. figs. 1–9.

N.B. These figures are on the scale of 1-12th to 1-5400th of an inch.

Fig. 1. Transparent cell, with rotatory protoplasm, charged with starch-granules. Usual form: *a*, cell-wall, flexible; *b*, rotating protoplasm, of which the current is indicated by the arrows; *c*, nucleus surrounded by starch-granules; *d*, axial cavity.

Fig. 2. The same, but a little larger. Cell-wall rigid.

Fig. 3. The same, germinating (?): *a*, cell-wall; *b*, rotating protoplasm charged with starch-granules, current indicated by the arrows; *c*, nucleus and starch-granules rotating *in situ* in the direction indicated by the arrows; *d*, axial cavity; *e*, tubular extension, which grew out to 1-70th of an inch in one hour; *f*, starch-granules, more magnified to show their characteristic shape.

Fig. 4. The same, with tubular extension less advanced.

Fig. 5. The same (but elliptical in form and larger) under the effect of iodine, to show:—*a*, outer cell-wall; *b*, inner cell-wall; *c*, starch-granules, rendered dark blue by the iodine; *d*, nucleus.

Fig. 6. The same, of a globular form, to show that state in which the cell-wall was sufficiently plastic to admit of the protrusion of short processes: *a a*, processes.

Fig. 7. The same, in which five cysts of an endophyte had developed themselves, and had enclosed nearly all the cell-contents. The reniform starch-granules replaced by oil-globules, some of which still remain outside the cysts. *a a*, cysts; *b*, oil-globules.

Fig. 8. The same, in which the cysts (three) of the endophyte had developed themselves, had pierced the cell-wall of their host, according to their custom, and had discharged their progeny into the water: *a a*, empty cysts; *b*, remaining oil-globules.

Fig. 9. The same, with three cysts of the endophyte, under iodine: *a a*, cysts containing protoplasm (sarcode?) and oil-globules, all rendered brown by the iodine; *b*, remainder of starch-granules and protoplasm outside the cysts rendered dark blue.

XXXV.—*Notulæ Lichenologicæ*. No. XXVII.

By the Rev. W. A. Leighton, B.A., F.L.S.

Dr. Nylander makes the following additions to our British Lichens in the 'Flora,' Aug. 30, 1868, and Nov. 8, 1868:—

1. *Pyrenopsis homœopsis*, Nyl.

Similis *P. grumuliferæ* Nyl. in Flora 1867, p. 369, sed sporis majoribus (longit. 0·011–0·018 millim., crassit. 0·007–0·010 millim.) et thallo intus (præsertim sub apotheciis) pallidiore, gonimiis majoribus (crassit. circiter 0·007 millim.). Thallus fuscus, tenuis, subgranulosus; apothecia in humido statu latit. circiter 0·2 millim.; epithecium incolor; paraphyses graciles. Iodo gelatina hymenea vinose rubens vel vinose fulvescens.